Application of Liquid Fertilizers at Time of Planting

HARVEY P. H. JOHNSON[1]

STARTER SOLUTIONS are now being considered for some vegetable crops. It seems logical that plant life should benefit from special nutritional practices in the early stages of growth much as animal life does. It was with this in mind that this test of early, small applications of liquid-fertilizer was made. The purpose was to determine whether small dosages of fertilizers applied around the seed might not give the plant greater vigor and strength in its early stages of growth thereby enabling the seedling to withstand disease and weather hazards during this critical period of growth. It was felt that the amounts added were not great enough to have much influence on final yield other than the carry-over effect resulting from faster and earlier development of the seedling. The test was made in cooperation with the Agricultural Engineering Department of Colorado A & M College at Fort Collins.

The chemicals included Fertidine, Calgon, Fume Phosphate (ground treble superphosphate), ammonium sulphate, ammonium nitrate and Uramon. The chemicals were used at different rates varying from ½ pound per acre to 5 pounds per acre. Chemicals were also used in combination. Fertidine,[2] an organic iodine compound, is prepared in the form of a black powder which is readily soluble in cold water. The formula of the unit cell is $C_{36}H_{60}O_{30}I_3$ or about 20 percent iodine by weight. Preliminary observations on its use have been made by Dr. Butler[3] and others with findings showing some increase in yield, particularly with root crops such as radishes, beets and carrots, when small applications of 1 pound per acre were made. Calgon[4] is a trade name for sodium hexametaphosphate, a high P_2O_5 containing phosphate salt commonly used as a water softener. Uramon[5] is a nitrogen carrying fertilizer containing 42 percent nitrogen. The remaining fertilizers need no further explanation as they are common commercial fertilizers.

Application of these fertilizers was made either in solution or suspension in water. When held in suspension a detergent was used. Water cans were fastened on top of a John Deere No. 55 planter with rubber tubing leading from the water can to a quarter-inch tube inserted in the fertilizer opening of the drill furrowing-out mechanism. The water solution was placed around the seed in the seed furrow then covered by the press wheel. Water application was made at the rate of 130 gallons per acre.

[1]Statistician-Agronomist, The Beet Sugar Development Foundation, Fort Collins, Colorado.
[2]Obtained from the Clairmint Chemical Company, Inc., 7 Lackawanna Avenue, Newark 2, N. J.
[3]Director of Research, Cooperative Grange League Federation, Ithaca, N. Y.
[4]Obtained from The Denver Fire Clay Company, Denver, Colorado.
[5]Obtained from DuPont Chemical Company, Wilmington, Delaware.

One-hundred-foot single-row plots were used with each plot replicated six times in a randomized-block design experiment. The entire row was harvested for yield with two sugar samples taken from each plot.

Early growth development was observed. When the beets were about 4 inches high two separate growth observations were recorded, one by Professor Ray Barmington of Colorado A & M College, and the other by the writer. Growth observations were recorded on the basis of giving a value of 6 to the no treatment check then assigning correspondingly higher values up to 10 for those rows in the same replication which appeared superior in growth development to the check and values down to 1 for those treatments inferior to the check. Table 1 gives the results for each treatment when values have been combined for the six replications. Each observer's results are noted together with a combined total. A correlation was made on the paired observations for each treatment. A high positive correlation of .81885 was obtained.

Table 1.— Visual results of early growth development of sugar beets due to the application of small quantities of fertilizer at time of planting.

Treatment	Observer 1	Observer 2	Total
1. Check (No treatment)	36	36	72
2. ½ pound Fertidine	38	36	74
3. 5 pounds Fume phosphate	38	38	76
4. 2½ pounds Uramon	35	38	73
5. 1 pound Calgon	40	41	81
6. 1 pound Fertidine	39	37	76
7. 1 pound Fume phosphate	42	40	82
8. 2½ pounds Uramon + 2½ pounds Fertidine	37	39	76
9. 2½ pounds Calgon	37	37	74
10. 2½ pounds Fertidine	36	33	69
11. 1 pound Fume phosphate + 2½ pounds Fertidine	38	37	76
12. 2½ pounds Ammonium sulphate	37	36	73
13. 5 pounds Calgon	37	39	76
14. 5 pounds Fertidine	34	37	71
15. 2½ pounds Ammonium nitrate	38	39	77
16. 2½ pounds Ammonium sulphate + 2½ pounds Fertidine	40	40	80
17. 1 pound Calgon + 2½ pounds Fertidine	37	36	73
18. 2½ pounds Uramon + 2½ pounds Calgon	38	39	77
19. 2½ pounds Ammonium nitrate + 2½ pounds Fertidine	37	38	75
20. 2½ pounds Uramon + 2½ pounds Calgon + 2½ pounds Fertidine	23	29	62

Growth observations were recorded on the basis of giving a value of 6 to the no treatment check then assigning correspondingly higher values up to 10 for those rows in the same replication which appeared superior in growth development to the check and values down to 1 for those treatments inferior to the check.

Table 1 shows that there were some visual differences in early growth development with the small dosages of P_2O_5 (treatments 5 and 7) showing up most favorably. Actually the differences were greater than might be suggested in small numerical differences. The combination of too many fertilizers (treatment 20) showed a definite retardation in growth. One-half pound and 1 pound dosages of Fertidine were superior to the heavier

rates. The nitrogen additives were better than the check but did not have the responses found with the phosphates. It is felt that more information is necessary on the combinations, particularly on rates of each.

Later in the growing season, these growth differences lessened until in late July when no contrasts could be observed. Table 2 shows the harvest data. As might be expected in this field of high fertility, no significant treatment differences were apparent. The fourth column "Average weight per beet" does show some significant differences, however, this should be interpreted with extreme caution as it is obvious that most all differences are due to a compounding effect from slightly smaller stands together with equal or slightly higher weights per plot.

Table 2. —Yields of sugar beets secured from applications of small quantities of fertilizer at time of planting.

Treatment[1]	Average total weight of roots per plot[2]	Average percent sucrose	Average number of beets per plot[2]	Average weight per beet	Average total sugar per plot (lbs.)[3]
Check	62	13.18	75	.826	8.1
½ pound Fertidine	58	13.48	75	.785	7.8
1 pound Fertidine	53	13.62	73	.719	7.2
2½ pounds Fertidine	52	13.57	68	.754	7.0
5 pounds Fertidine	54	13.25	66	.817	7.2
1 pound Calgon	56	13.05	72	.780	7.3
2½ pounds Calgon	59	12.95	64	.917	7.6
5 pounds Calgon	63	12.70	64	.987	8.0
1 pound Fume phosphate	57	13.40	76	.757	7.6
5 pounds Fume phosphate	60	13.33	75	.792	7.9
2½ pounds Uramon	57	13.07	74	.777	7.5
2½ pounds Ammonium sulphate	56	13.12	71	.797	7.4
2½ pounds Ammonium nitrate	56	13.27	69	.817	7.5
2½ pounds Fertidine + 2½ pounds Uramon	59	13.20	71	.815	7.7
2½ pounds Fertidine + 2½ pounds Ammonium sulphate	60	13.35	69	.881	8.0
2½ pounds Fertidine + 2½ pounds Ammonium nitrate	61	12.77	75	.824	7.9
2½ pounds Fertidine + 1 pound Fume phosphate	58	13.38	76	.765	7.8
2½ pounds Fertidine + 1 pound Calgon	52	12.90	68	.770	6.8
2½ pounds Uramon + 2½ pounds Calgon	60	12.93	72	.848	7.8
2½ pounds Uramon + 2½ pounds Calgon + 2½ pounds Fertidine	55	12.80	69	.798	7.1
L.S.D. 5 percent point	[3]	[3]	[3]	.069	[3]
L.S.D. 1 percent point	[3]	[3]	[3]	.091	[3]

[1]Each treatment, including the check, was applied with water at the rate of 130 gallons per acre.

[2]Each plot 100 feet in length. Entire plot harvested.

[3]No significant difference.

Conclusions

It is apparent that this test is only exploratory and that further work is necessary to substantiate proper trends and adequate dosages. It is interesting to note, however, that early plant stimulation can be obtained by small and inexpensive applications of fertilizer at the time of planting. The phosphates showed greater response than the nitrogens. There is a danger of making too heavy applications thereby obtaining toxic rather than beneficial effects.